Lesson X

- Executable Format and Boot Loader
- JTAG
- C vs. C++
- Volatile Variable
- Random Topics

Executable Format and Boot Loader

JTAG

C vs. C++

Typically, C design pattern to create a re-usable module is performed like so:

```
typedef struct {
  int target_ms;
  int interval_ms;
} timer_t;
void timer_start(timer_t *t, uint32_t interval);
void timer_stop(timer_t *t);
bool timer_expired(timer_t *t);
```

On the other hand, C++ for the same module would be:

```
class timer
{
  public:
    void start(uint32_t interval);
    void stop();
    bool expired();

  private:
    int target_ms;
    int interval_ms;};
```

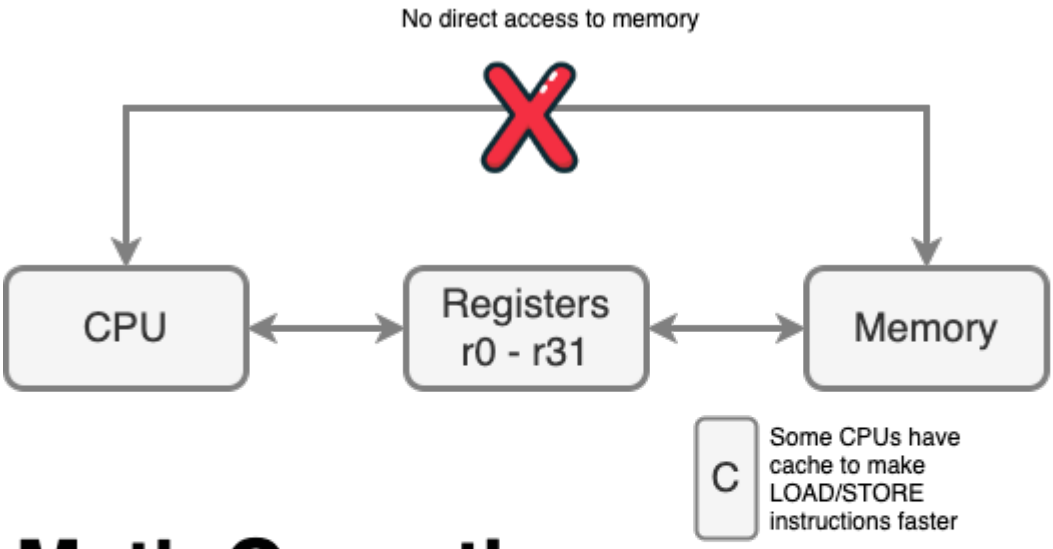
Code analysis

```
void main(void)
{
```

```
/**
 * C convention:
 *   object_method(&obj)
 * Then you pass the object as the first parameter to the methods to "operate on" this object
 */
timer_t t;
timer_start(&t, 1000);
timer_stop (&t);

/**
 * C++ convention:
 *  obj.method()
 *
 * C++ automatically passes the object pointer, known as the "this"  pointer to the method
 * In reality, the language and the compiler is invoking the methods just like C:
 *    timer::start(&obj, 1000);
 */
timer t;
t.start(1000);
t.stop();}
```

Volatile Variable



Math Operation

```
int x = 0;  LOAD R0, &x (memory address)
            INCR R0
++x;        STORE R0, &x
```

```
// volatile
int flag; // global memory is part of "BSS" section, guaranteed to be zero (unless a bug in startup co
void flag_setter_task(void *p) {
  while (1) {
    ++flag;
    vTaskDelay(1000);
  }
}
void flag_checker_task(void *p) {
```

```
  puts("Task entry");
  while (1) {
    flag = 0;
    while (0 == flag) {
      ;
    }
    puts("flag has incremented away from value of 0");
    vTaskDelay(1000);
  }
}
```

Interview Questions

- What is a `volatile` keyword?
- Given a code snippet, why you cannot set a breakpoint?
- Is `const` opposite of volatile?
- What is the point of "`const volatile *variable`" ?
  - You as a programmer, cannot write a line of code to modify, but maybe DMA or a peripheral behind you can modify it

Random Topics

Useful topics to learn about:

- Avoid dynamic memory after RTOS starts
  - Avoiding task deletions
- APIs to avoid in FreeRTOS
- How much sleep time will vTaskDelay(1) actually sleep the task?
- Clock system review
  - Peripheral clock divider
  - CPU PLL